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United States Patent [19]

Mazakas

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[45] Date of Patent: Aug. 17, 1993

[54] **METHOD FOR INSTALLING A PORTABLE SPRAY BOOTH LINER**

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[21] Appl. No.: **906,264**

[22] Filed: **Jun. 26, 1992**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 851,743, Mar. 16, 1992, which is a continuation-in-part of Ser. No. 725,021, Jul. 3, 1991, abandoned.

[51] **Int. Cl.**[5] **B05C 15/00;** B05B 15/12

[52] **U.S. Cl.** **118/634;** 427/421; 118/309

[58] **Field of Search** 118/634, 309, 326; 55/DIG. 46; 52/2.11, 2.15, 2.25, 79.5; 427/421

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,845,910	7/1989	Hanson et al.	52/DIG. 13
4,924,803	5/1990	Celant	118/326

FOREIGN PATENT DOCUMENTS

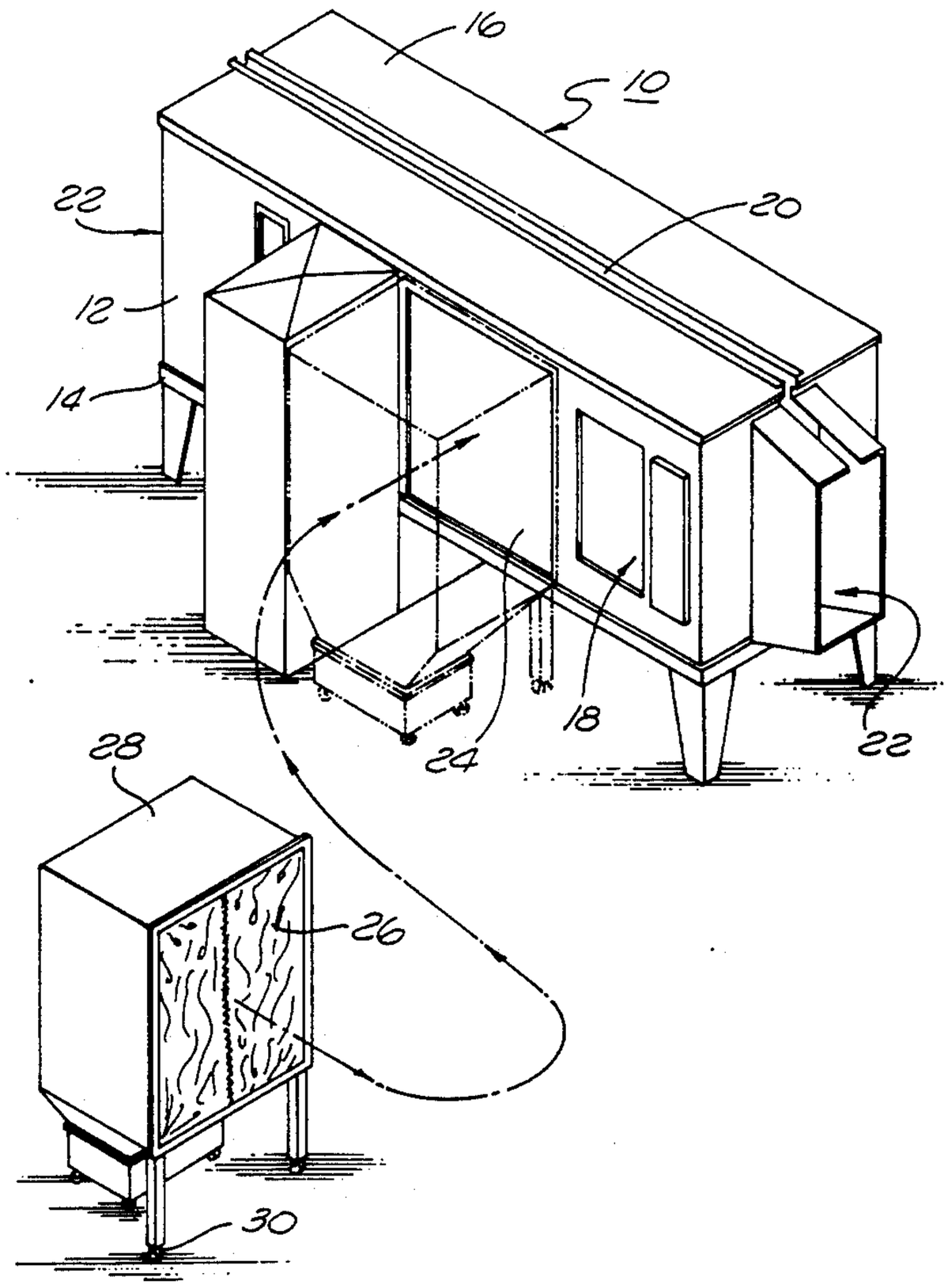
8902788 4/1989 World Int. Prop. O. .

Primary Examiner—W. Gary Jones
Assistant Examiner—Charles K. Friedman
Attorney, Agent, or Firm—Blakely, Sokoloff, Taylor & Zafman

[57] **ABSTRACT**

A liner module that can be coupled to a spray booth. The module includes a liner folded into a portable cabinet. The liner has a zipper that closes a liner cavity. The liner can be unfolded from the cabinet, unzipped and attached to the inner walls of the spray booth. An electrostatic paint gun is typically used to spray paint powder onto an object located within a spray chamber of the booth. The spray gun produces excess paint powder which is drawn into a filter system. The liner is constructed to prevent the excess paint powder from adhering to the inner walls of the spray booth. The module also contains a primary filter that captures the paint powder as the powder is pulled from the spray booth into the filter system.

3 Claims, 6 Drawing Sheets



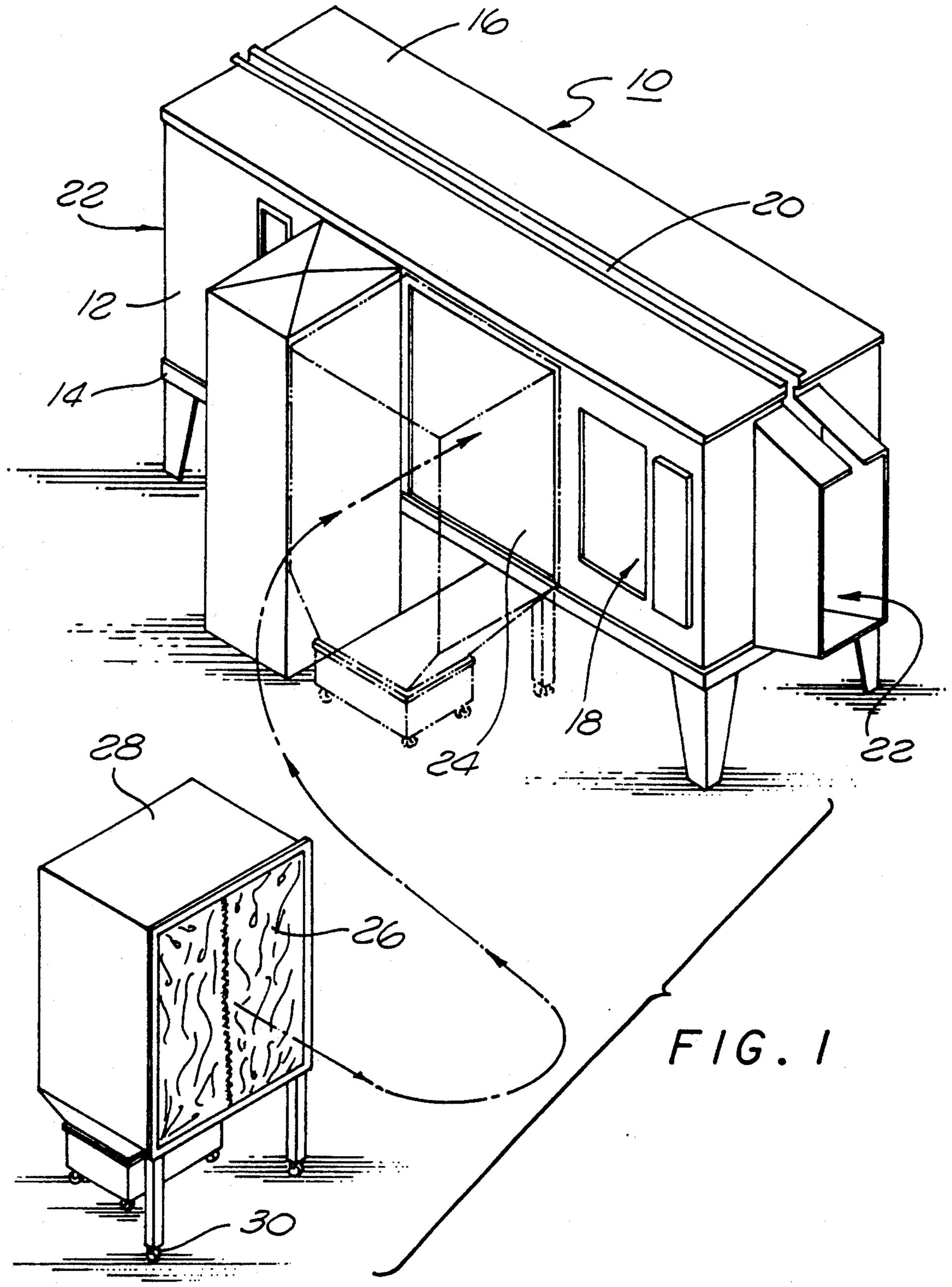


FIG. 1

FIG. 2

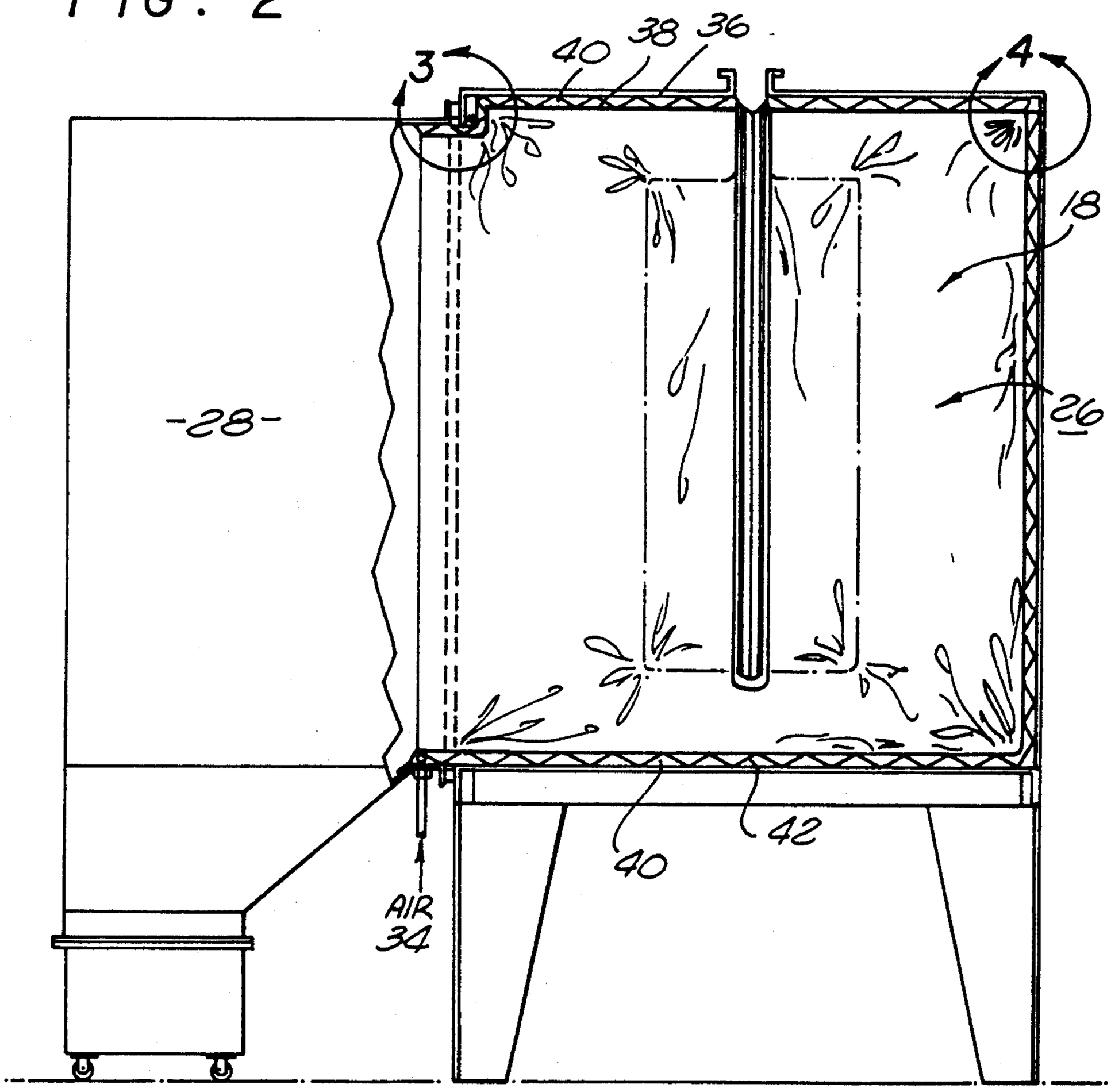


FIG. 3

FIG. 4

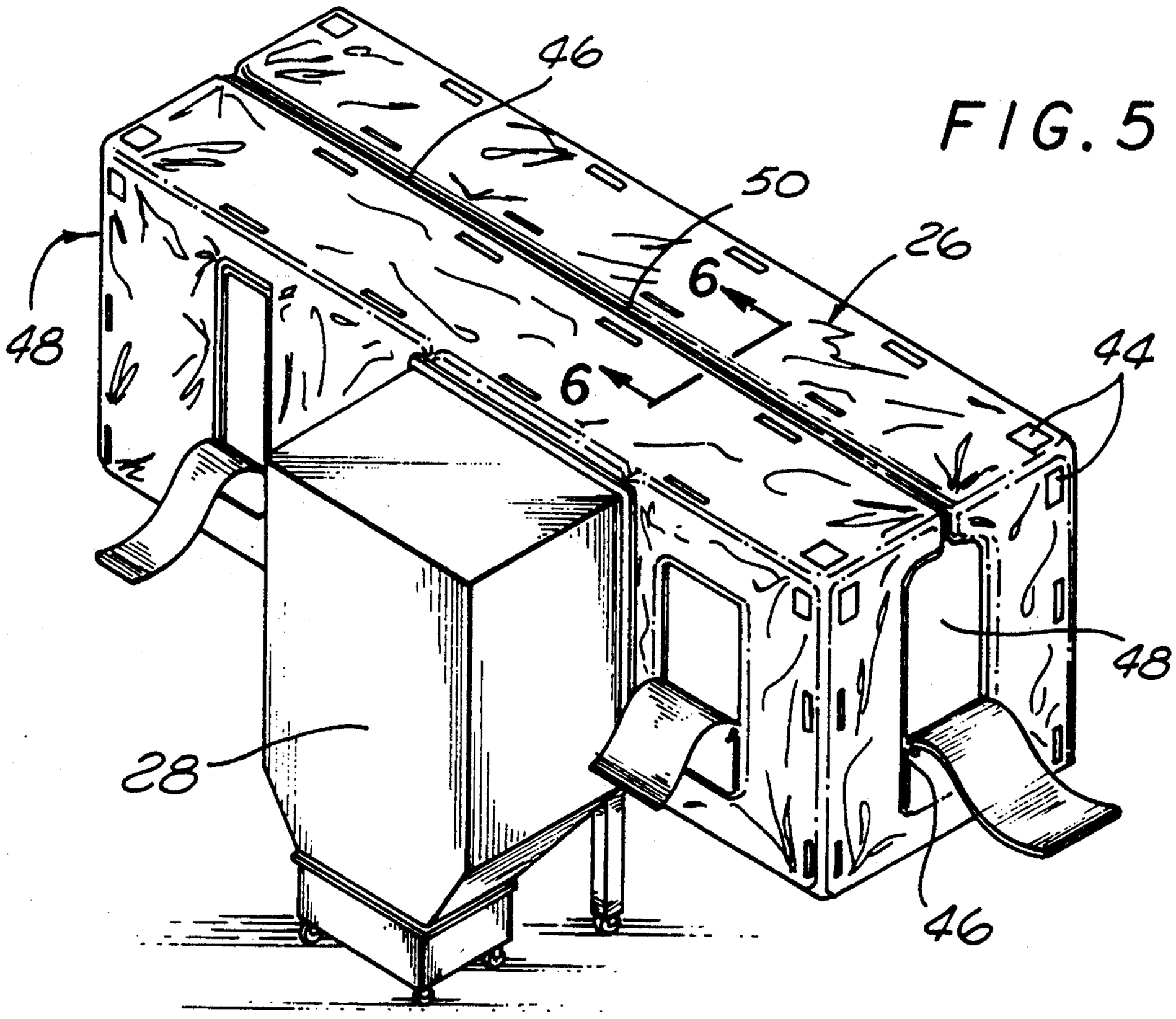


FIG. 5

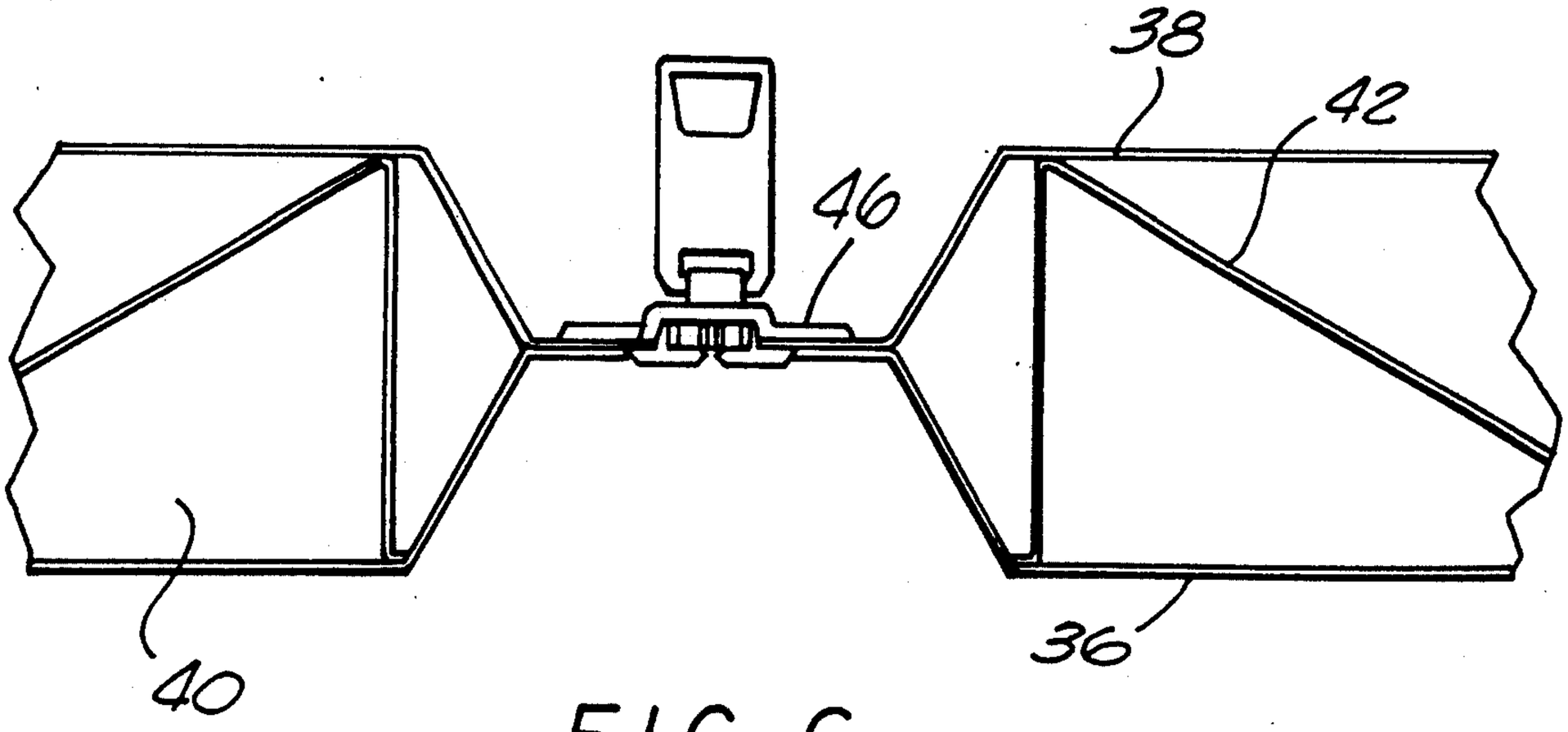


FIG. 6

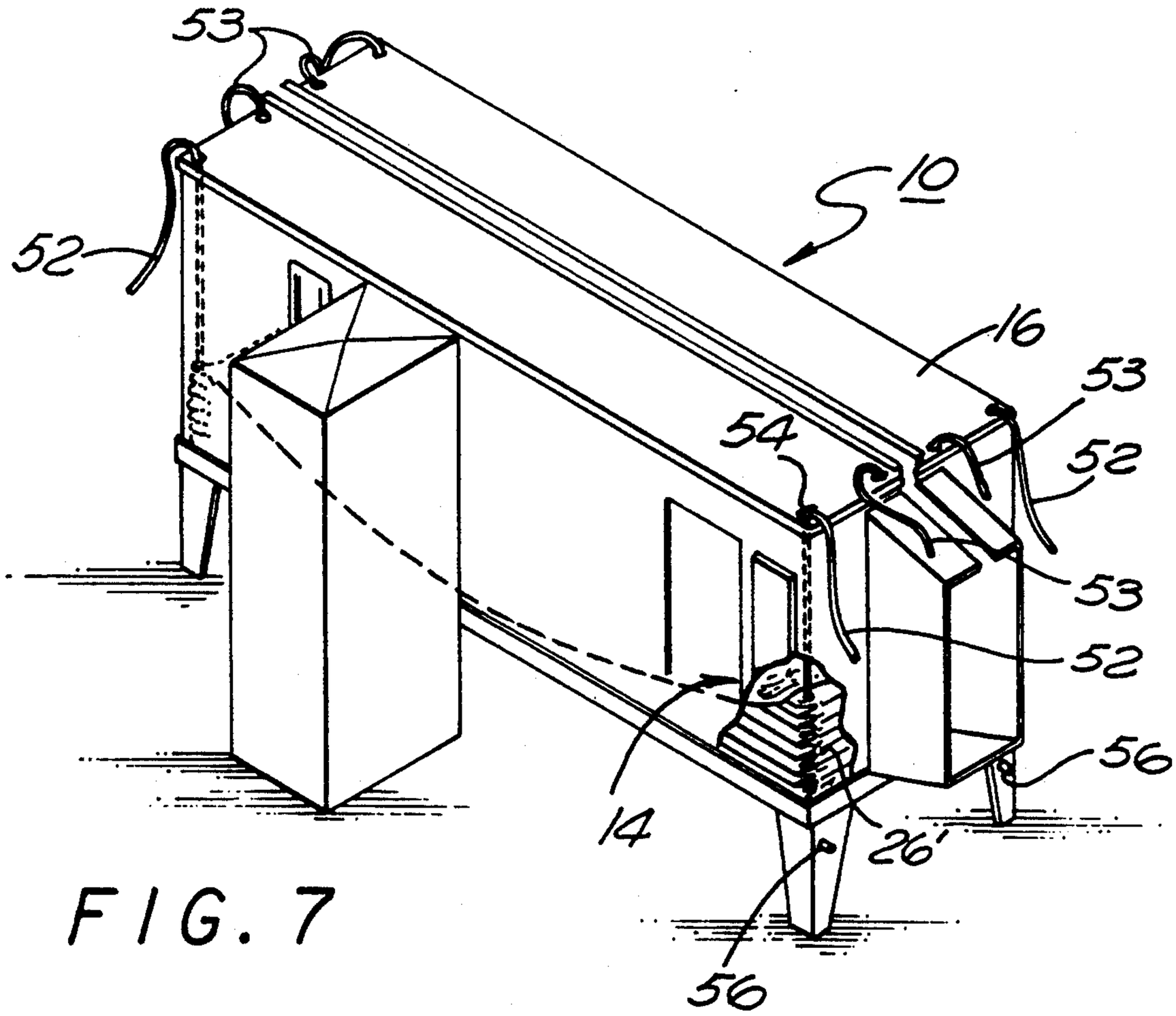

53
10
52
16
53
54
52
53
52
56
14
26'
56

FIG. 7

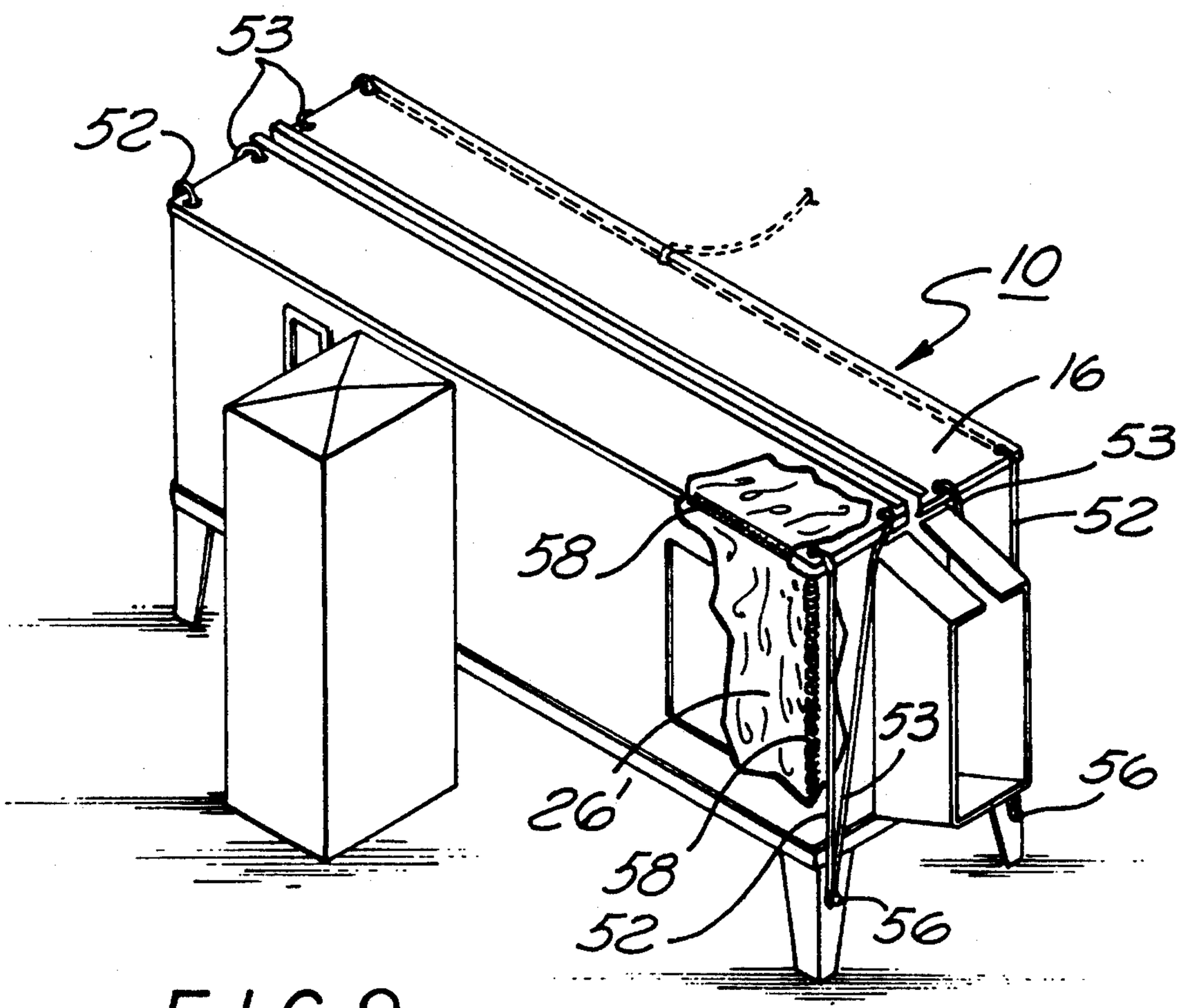

53
52
10
16
53
52
58
53
56
26'
58
52
56

FIG. 9

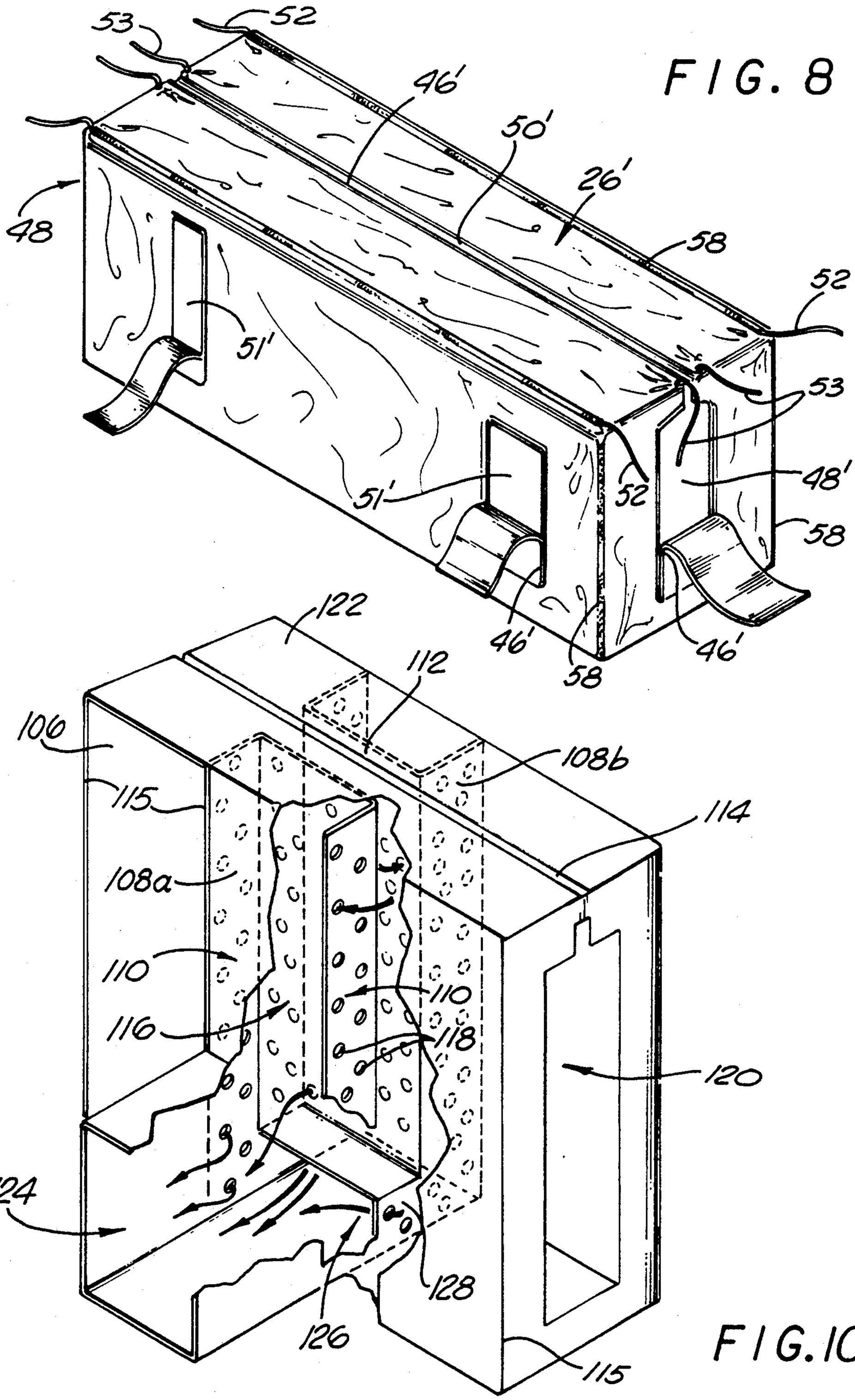

53
52
46'
50'
26'
48
58
52
51'
53
48'
51'
52
58
46'
46'
58
122
112
106
108b
115
114
108a
110
110
116
118
120
124
126
128
115

FIG. 8

FIG. 10

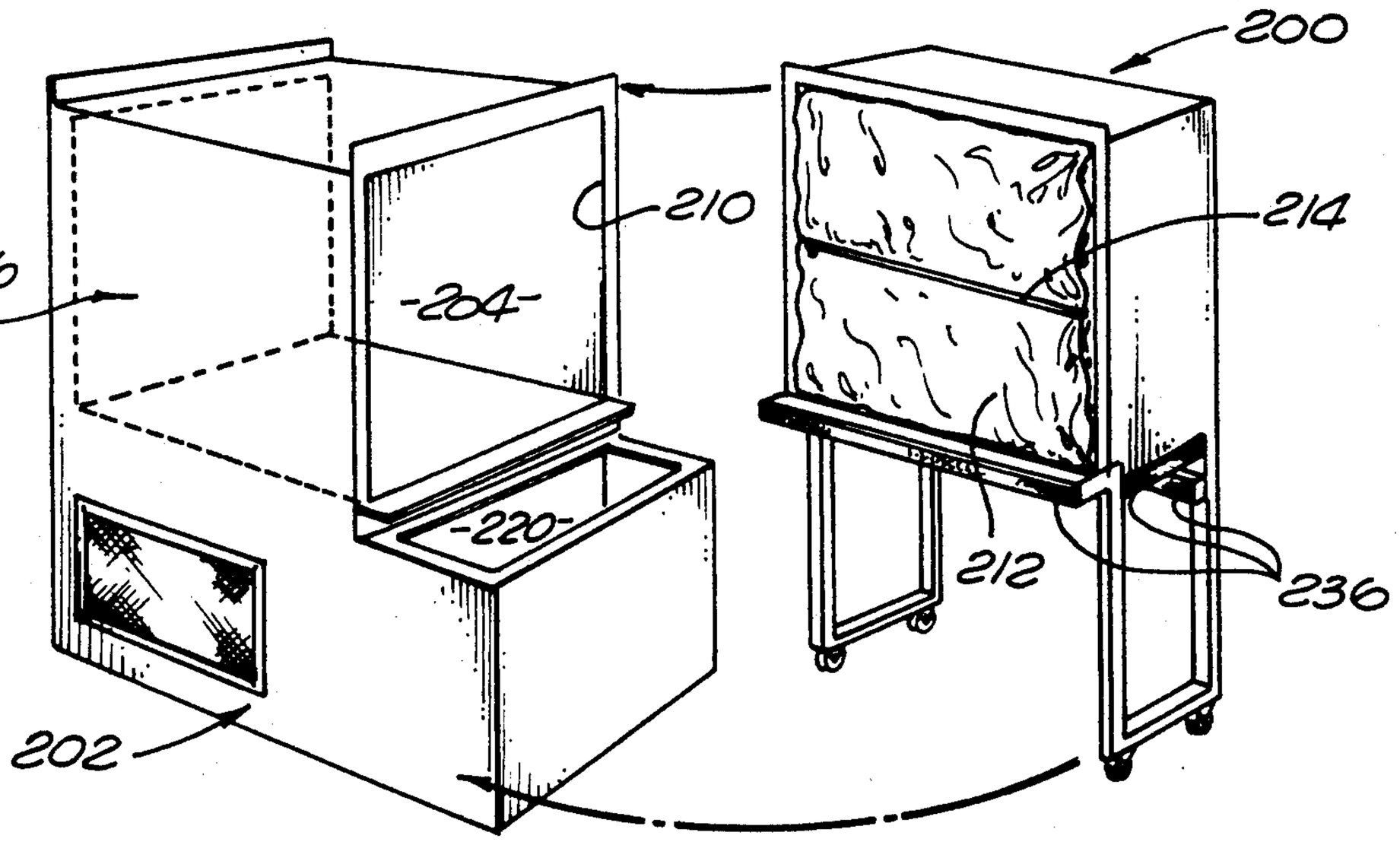
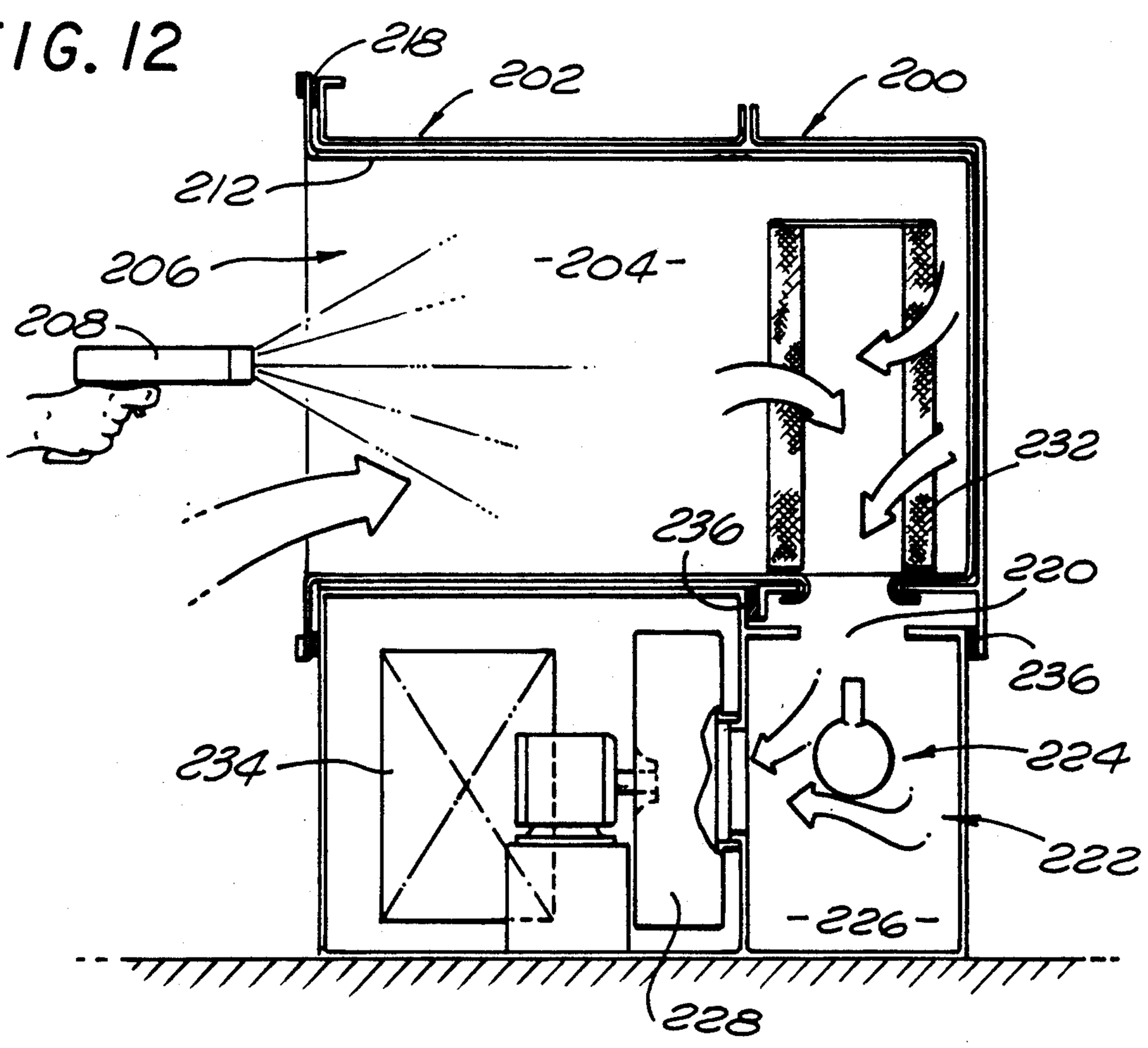

200
210
214
206
204
220
212
236
202

FIG. 11

FIG. 12


218
202
200
212
206
204
208
232
236
220
224
234
222
226
228

METHOD FOR INSTALLING A PORTABLE SPRAY BOOTH LINER

This application is a continuation-in-part of application Ser. No. 07/851,743, filed on Mar. 16, 1992 which is a continuation-in-part of application Ser. No. 07/725,021 filed on Jul. 3, 1991 now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to spray booths used to coat workpieces with electrically charged resin powder.

2. Description of Related Art

Electrostatic powder paint spray booths are becoming much more common because of the hardened and improved finish provided by such methods, and the much reduced pollution resulting therefrom. This type of painting comprises spraying electrically charged paint powder onto workpieces that are at ground potential. The charged powder is attracted and adheres to the grounded workpieces, which are then baked in an oven to melt the powder, causing the powder to flow and cover the workpieces. Typically the pieces are hung on racks that pass through a spray booth, wherein a spray gun applies the powdered paint as the parts pass by. The booth is usually a rectangular box with entrance and exit openings, and a slot along the top to allow the hangers and parts to pass through the booth. The booths typically also have a filter system to remove and recover the excess powder that does not adhere to the parts, it being found that the powder will not stick to the pieces after a certain thickness of powder has built up on the part to neutralize the charge.

The spray gun and filter are usually a detachable unit so that it is easy to convert those parts of the spray booth system to a new color. Unfortunately the powdered resin also sticks to the inside of the rectangular booth, which is typically constructed from metallic walls that attract the charged paint powder. When the booth is converted to a new color, the inside of the booth must be cleaned of old powder to insure that none of the old color powder mixes with the new color powder. This is a costly, time consuming task that can shut down a whole assembly line for a long time.

U.S. Pat. No. 4,924,803 issued to Celant and Danish Reference No. 89/02788 by Andersen disclose a single plastic liner that covers the inside of the booth, wherein the liner can be removed and replaced by a different liner when a color change is desired. The single liner concept is difficult and dangerous to install. When the single liner is blown into place within the inside of the paint booth, air will leak out through the zippers and other necessary unsealable openings. Because the walls of the liner contain powder, the air that leaks out of the inflated cover will also contain powder. The powder is toxic, wherein the release of paint into the surroundings will create an undesirable environmental condition. Thus it is not practical to blow-up a single liner of the prior art with air to install it in the spray booth chamber. Additionally, both the Celant and Andersen devices require pressure or vacuum means to install and suspend the liners, thereby increasing the complexity and cost of the installation and overall assembly.

SUMMARY OF THE INVENTION

The present invention is a liner module that can be coupled to a spray booth. The module includes a liner

folded into a portable cabinet. The liner has a zipper that closes a liner cavity. The liner can be unfolded from the cabinet, unzipped and attached to the inner walls of the spray booth. An electrostatic paint gun is typically used to spray paint powder onto an object located within a spray chamber of the booth. The spray gun produces excess paint powder which is drawn into a filter system. The liner is constructed to prevent the excess paint powder from adhering to the inner walls of the spray booth. The module also contains a primary filter that captures the paint powder as the powder is pulled from the spray booth into the filter system.

The cabinet is portable so that different modules, each associated with a different paint color, can be coupled to the booth. To change paint colors, the liner is zipped and folded back into the cabinet. The excess paint powder within the spray chamber is contained by the inner cavity of the liner. The liner prevents excess paint powder from adhering to the walls of the spray booth so that one paint color is not contaminated by paint powder of a different color.

Therefore it is an object of this invention to provide a spray booth liner that can be readily attached to and removed from a spray booth.

BRIEF DESCRIPTION OF THE DRAWINGS

The objects and advantages of the present invention will become more readily apparent to those skilled in the art after reviewing the following detailed description and accompanying drawings, wherein:

FIG. **1** is a perspective of a paint spray booth showing the attachment of a portable cabinet having an inflatable double layered liner;

FIG. **2** is a side view of a double layered liner inflated and attached to the inner cavity of a spray booth;

FIG. **3** is an exploded view of FIG. **2**, showing the attachment of the portable cabinet and liner to the spray booth;

FIG. **4** is an exploded view of FIG. **2**, showing the attachment of the liner to a corner of the booth cavity and a corrugated member between the liner walls to add structural support to the liner;

FIG. **5** is a perspective view of an inflated double layered liner showing zippers that expose openings and a slot to allow workpieces (not shown) to pass through the booth;

FIG. **6** is a cross-sectional view of FIG. **5** showing a zipper attached to the liner;

FIG. **7** is a perspective view showing a spray paint booth with a liner than can be lifted into position by cables;

FIG. **8** is a perspective view similar to FIG. **5**, showing the liner of FIG. **7**;

FIG. **9** is a view similar to FIG. **7** showing the liner lifted into an operating position;

FIG. **10** is a perspective view of another alternate embodiment of the present invention, wherein the liner has a pair of air ducts integrated therein;

FIG. **11** is a perspective view of another alternate embodiment of the present invention;

FIG. **12** is a cross-sectional view of a liner extending from a portable cabinet and attached to the inner walls of a spray booth.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the drawings more particularly by reference numbers, FIG. **1** shows a paint spray booth **10**

typically used to enclose workpieces (not shown) that are sprayed by an electrostatic spray gun. The booth **10** comprises four walls **12**, a floor **14** and a ceiling **16**, that encloses a booth cavity **18**. The booth **10** has a slot **20** and openings **22** that allow the parts, which are hung on hangers that move along a conveyor, to pass through the booth **10**. The booth **10** has an access window **24** to allow a liner **26** to be inserted into the cavity of the booth **10**. The liner **26** can be packed into a cabinet **28**. The cabinet **28** may have wheels **30** allowing the cabinet **28** to be rolled to and from the access window **24**, such that the cabinet **28** can be easily transported and attached to the booth **10**. There may be a plurality of portable cabinets, each cabinet **28** corresponding to a different powder color.

FIG. **2** shows the liner **26** installed within the cavity **18** of the booth **10**. Installation may be accomplished by unfolding the liner **26** from the cabinet **28**, attaching the liner **26** to the booth walls **12** and ceiling **16** and inflating the liner **26** with a fluid medium **34**, preferably air, from a compressor or the like (not shown). The liner **26** has a first outside layer **36** constructed to conform to the shape of the booth cavity **18** and a second inside layer **38** attached to the first layer **36**, such that there is an inflatable compartment **40** between the first **36** and second **38** layers. The layers are made from a flexible bag like material that allows the compartment **40** to expand when air **34** is introduced to the same. To add structural support to the compartment **40**, a support member **42** may be inserted between the first **36** and second **38** layers. In the preferred embodiment, the support member **42** is a corrugated sheet extending through the compartment **40**, with the sheet being constructed from a flexible material such that the liner **26** easily collapses when the compartment **40** is deflated. The spring like sheet also aids the expansion of the compartment **40**, by inducing separation of the layers to make sure certain portions of the liner **26** are not pinched or collapsed. It being desirable to have the electrically insulating air gap separating the booth and charged powder over as much area as possible, to prevent the attraction of the powder to the metallic booth walls. The second inside layer **38** can be porous, allowing the pressurized air **34** to blow through said layer **38** into the cavity **18**, to prevent powdered paint from attaching to the liner **26**. With this embodiment, the compressor or other source of air would have to be in constant operation to supply a constant source of pressurized air **34**. The porous second inside layer can be constructed by creating a plurality of small apertures throughout the second layer **38**. The liner **26** may be attached to the booth by hook and loop material sold under the Trademark "VELCRO" **44**, as shown more clearly in FIGS. **3** and **4**, wherein the liner **26** has patches of loops that mate with corresponding hooks attached to the booth **10**. The liner **26** may be connected to the booth **10**, by hooks, or hangers or any other suitable means for covering the cavity **32** walls.

The liner **26** could be constructed such that the liner **26** could cover the cavity walls without being attached to the booth **10**, an embodiment particularly viable for small booths. The liner **26** would be inflated into the desired predetermined shape after the liner **26** is unfolded inside the booth cavity **18**. The corrugated sheet **42** could provide additional structural support to help suspend the liner **26** within the booth cavity **18**. FIGS. **3** and **4** show desirable sheet **42** shapes to help define the corners of the liner **26**. The cabinet **28** and liner **26** could be constructed, such that the liner **26** is inflated while still in the cabinet **28**, wherein the liner **26** "opens up" into the booth **10**. In this arrangement the liner **26** would still have to be folded back into the cabinet **28** after the compartment **40** is deflated.

FIG. **5** shows an inflated liner **26**, with zippers **46** that unzip portions of the liner **26**, such that there are liner openings **48** and a liner slot **50** that are of approximately the same dimensions and locations as the openings **22** and slot **20** of the booth **10**. The openings **48** and slot **50** allow workpieces to travel through the liner **26** and booth **10**. The zippers **46** can also create side openings **51** to allow further access to the cavity for the spray gun or for other means. There may be another side opening on the opposite side (not shown) for spray gun access. FIG. **6** more clearly shows the attachment of the zipper **46** to the liner **26**, wherein the zipper **46** seals off the compartment **40**. The liner openings **48** and slot **50** can also be attached with hook and loop material or other fastening means.

To install the preferred embodiment a portable cabinet **28** is rolled up to the access window **24**. The liner **26** is unfolded into the booth cavity **18**. The compartment **40** is then inflated to a point where it can be attached to the cavity walls **12**. The zippers **46** are unzipped creating the openings **48** and slot **50**. The liner **26** is then ready for use. When a new color is desired, the liner **26** is zipped, deflated, detached and folded back into the cabinet **28**, which is wheeled away and replaced by another cabinet **28** to be used with the new color.

The liner **26** could be utilized as a self-supporting paint spray enclosure, wherein the liner is used without a metallic booth **10**. The layer material and/or corrugated sheets could provide enough structural rigidity such that the liner is defined and self-supported as shown in FIG. **5**. To provide further support, the corners of the liner **26** could be tied to the floor and ceiling such that the liner is suspended like a tent. Thus the present invention could be used as a replacement for the expensive heavy booths that are used today. By deflating and removing the liner the floor space can then be utilized for other uses.

FIGS. **7** and **8** show an alternate embodiment of a single layer liner **26'** that can be lifted into position from outside the spray booth **10**. The liner **26'** may have zippers **46'** that allows openings **48'** and **51'**, and a slot **50'** to be formed therein. The corners of the liner **26'** can be attached to cables **52** that extend through openings **54** in the booth **10**. The liner **26'** may also have cables **53** attached to the edges of the liner adjacent to the slot **50'**. The cables **53** insure that the liner **26'** is adjacent to the cavity wall in the area around the slot **50'**.

The liner **26'** is initially in a flat position on the floor **14** of the booth. As shown in FIG. **9**, the liner **26'** is lifted into position by pulling the cables **52** and **53** in a downward direction, until the top and sides of the liner **26'** completely cover the inner surface of the booth **10**. The bottom corners of the liner **26'** are typically fastened to the floor **14**, to prevent the bottom of the liner from being pulled up by the cables.

To keep the liner **26'** upright, the cables **52** can be tied to studs **56** extending from the legs of the booth **10**. The liner **26'** may have four individual cables **52**, or two pairs of cables as shown in phantom in FIG. **9**. The combination of cables reduces the number of people or steps needed to lift the liner **26'**. The edges of the liner **26'** preferably have an elastic element **58** or material therein, so that when the cables are untied, the elastic

material **58** pulls the liner **26'** back into the flat position. The liner **26'** can then be folded and removed from the booth. A new liner may be unfolded onto the floor **14** and lifted into place. The new liner is typically used when a different color of paint is sprayed onto the workpieces. The cables **52** and **53** can be attached to a single layer liner or the double layer liner shown in FIGS. **1–6**.

FIG. **10** shows another embodiment of the present invention, wherein the liner **106** has a pair of air ducts **108***a* and **108***b* integrated therein. The liner **106** may be the double layer liner shown in FIGS. **1–6** or the single layer liner shown in FIGS. **7–9**. Each duct **108** typically has a pair of sidewalls **110** that extend from the liner **106**. Attached to each sidewall **110** is a front wall **112** that is essentially parallel with the slot **114**. The edges of the walls may contain elastic material **115**, so that the ducts **108** readily collapse when the cables are released (single layer), or the compartment is deflated (double layer). The ducts **108** have inner passages **116** extending the length of the walls. Each wall also has a plurality of holes **118** that provide communication between the inner cavity **120** of the booth **122** and the passages **116**.

Attached to the booth **122** is a filter unit **124** that contains a number of filters (not shown) that remove the electrostatic paint powder from the air. The liner **106** has an opening **126** that provides communication between the duct passage **116** and the filter unit **124**. Because only one filter is typically employed, the liner **106** may include a secondary duct **128** that allows air to flow from the duct **108***b* to the duct **108***a*. A fan unit (not shown) is typically employed to pull the air from the inner cavity **120** of the booth, through the filters and into the ambient. The ducts provide a means for directing the paint powder to the filter, thereby reducing the amount of paint powder that adheres to the liner **106**.

FIGS. **11** and **12** show another embodiment of the present invention, which includes a portable cabinet **200** that can be coupled to a stationary spray booth **202**. The spray booth **200** has a spray chamber **204** large enough to contain one or more objects (not shown) that are to be painted. The booth **200** has a front opening **206** through which a spray gun **208** sprays electrostatically charged dry paint powder into the spray chamber **204**. The cabinet **200** has a rear opening **210** which provides access to a liner **212**. The liner **212** is constructed from a material that is impermeable to the paint powder and has the form of a bag. The liner **212** includes a zipper **214** that provides access to a liner cavity. The cabinet **200** also has wheels that allow the liner **212** to rolled to and from the spray booth **202**. A typical paint area may have a plurality of cabinets **200** each used with an associated paint color.

As shown in FIG. **12**, the cabinet **200** is rolled up to the rear opening **210** of the booth **202**. The liner **212** is then unfolded into the spray chamber **204**. The zipper **214** is unzipped and the liner **212** is then attached to the spray booth **202**. The liner **212** may be secured to the walls of the booth **202** by any fastening means **218**. For example, the outer surface of the liner **212** and the inner surface of the booth **202** may have hook and loop material (VELCRO) that allow the members to be fastened together. The liner **212** covers the entire surface of the spray booth **202** so that paint powder does not adhere to the walls of the booth **202**.

The cabinet **200** has a filter opening **220** that allows fluid communication between the spray chamber **204** and a filter assembly unit **222**. The filter unit **222** includes a blow down filter **224** within a blow down chamber **226** and an exhaust fan **228** that pulls air from the spray chamber **204**. The fan **228** is constructed to provide an air flow high enough to circulate the paint powder without preventing attachment of the powder to the part.

A primary filter **232** may be placed above the opening **220**. The primary filter **232** typically remains within the liner **212** even when the cabinet **200** is detached from the booth **202**. The primary filter **232** is constructed to capture the paint powder as the air flows from the spray chamber **204** into the opening **220**. Any powder that escapes the primary filter **232** can be captured by the blow down filter **224**. The unit **222** may have an exhaust filter **234** to insure that no powder is blown back into the ambient.

When a new paint color is desired, the liner **212** is detached from the paint booth **202**, zipped, folded back into the cabinet **200** and rolled away from the booth **202**. A new cabinet with another associated color is then rolled up to the booth and the enclosed liner is installed. The spray booth **202** and filter unit **222** may have gaskets **236** that seal the cabinet **200** to the booth **202** and unit **222**. In the alternative, the gaskets **236** may be attached to the cabinet **200**. What is thus provided is a portable liner that allows the user to readily change paint colors without cleaning the walls of the spray booth.

While certain exemplary embodiments have been described above and shown in the accompanying drawings, it is to be understood that the embodiments are merely illustrative of, and not restrictive on the broad invention, and that this invention should not be limited to the specific constructions and arrangements shown and described, since various other modifications may occur to persons having ordinary skill in the art.

What is claimed is:

1. A method of covering inner walls of a spray booth which contains workpieces that are sprayed with electrostatic paint powder, wherein the spray booth has a first opening, comprising:

a) providing a portable cabinet that has a liner which can be moved between a folded position and an unfolded position, said liner having a zipper which can be manipulated to create a first liner opening and fastening means for attaching said liner to the inner walls of the spray booth;

b) moving said portable cabinet adjacent to the first opening of the spray booth;

c) pulling said liner into the unfolded position;

d) manipulating said zipper to create said first liner opening; and;

e) attaching said liner to the inner walls of the spray booth.

2. The method as recited in claim **1**, further comprising the steps of;

f) detaching said liner form the inner walls of the spray booth;

g) manipulating said zipper to close said first liner opening;

h) folding said liner into said portable cabinet;

i) moving said portable cabinet away from the first opening of the spray booth.

3. The method as recited in claim **2**, further comprising the steps of;

b) moving said portable cabinet adjacent to the first opening of the spray booth;

c) pulling said liner into the unfolded position;

d) manipulating said zipper to create said first liner opening; and,

e) attaching said liner to the inner walls of the spray booth.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 5,236,506

DATED : August 17, 1993

INVENTOR(S) : Mazakas

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In claim 2 in column 6 at line 54 change "form" to --from--.

Signed and Sealed this

Thirteenth Day of June, 1995

Attest:

BRUCE LEHMAN

Attesting Officer

Commissioner of Patents and Trademarks